CYBERSECURITY OPPORTUNITIES IN VIRGINIA

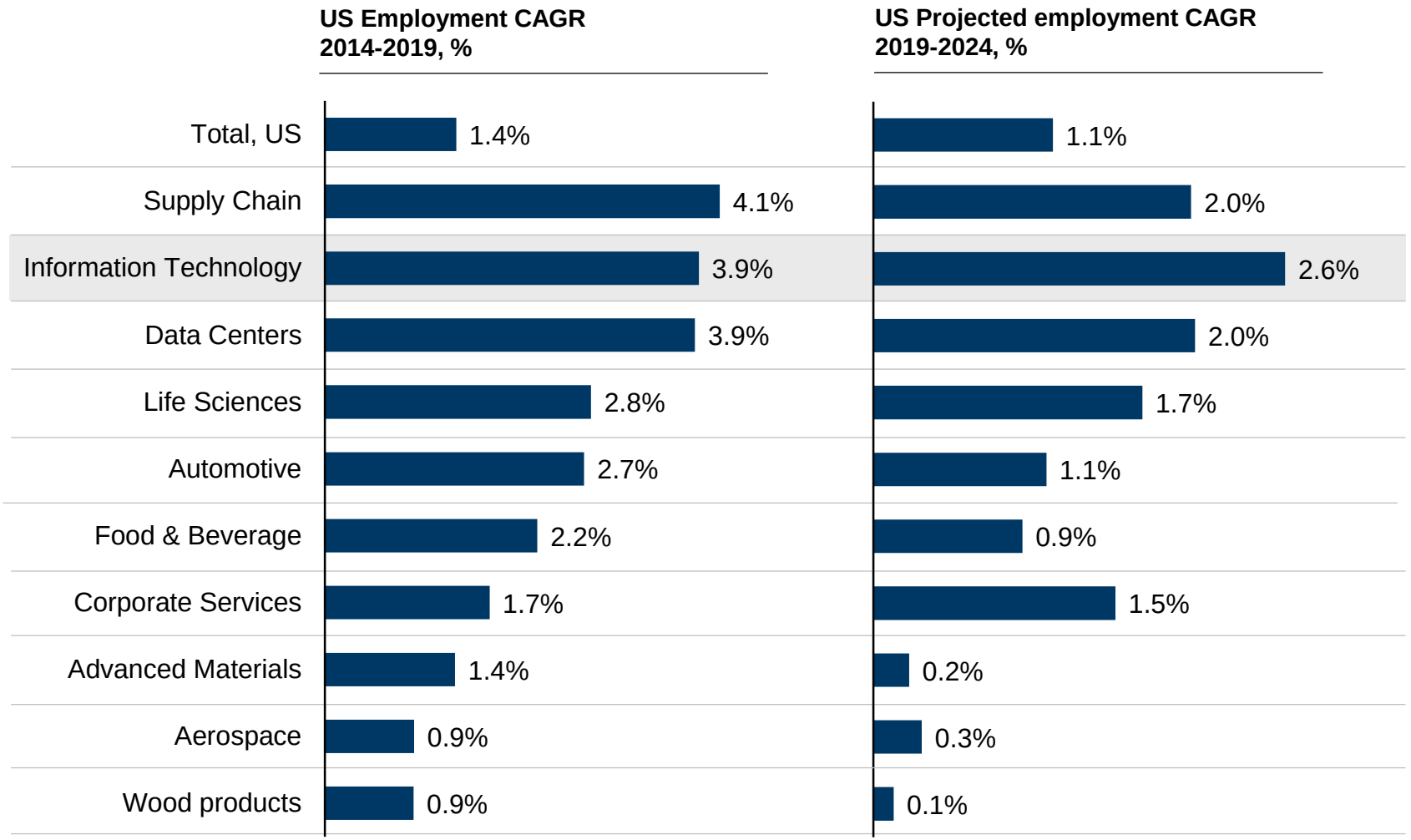
December 4, 2019

VEDP Virginia Economic Development Partnership VEDP.org

TOPICS FOR TODAY'S DISCUSSION

- Overview of employment and growth in the cybersecurity sector
- Opportunities to strengthen Virginia's position in the cybersecurity industry
- VEDP's current business development efforts for cybersecurity
- Next steps

TECH SECTOR GROWTH IN THE US HAS BEEN STRONG AND IS PROJECTED TO BE THE HIGHEST-GROWTH VS. OTHER SECTORS



Source: BLS, QCEW

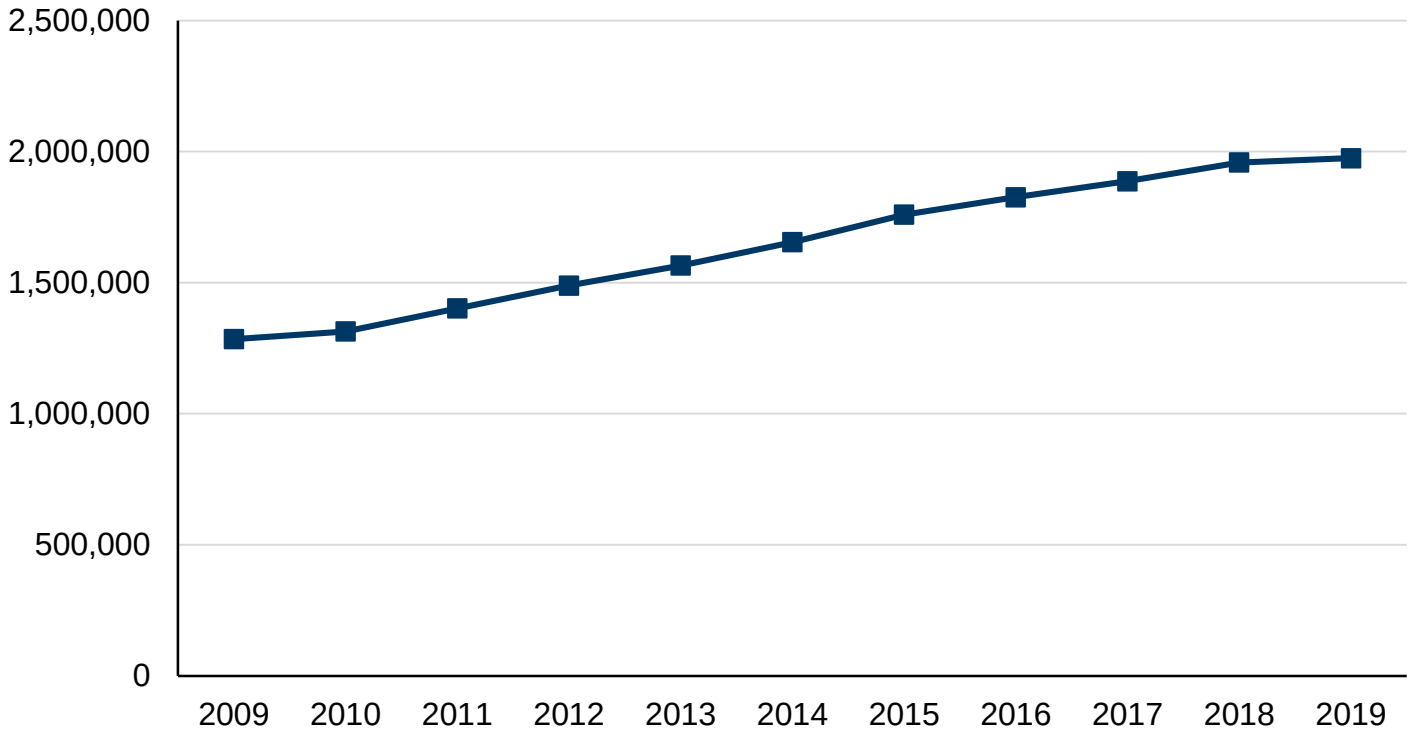
CYBERSECURITY IS A PILLAR OF THE TECH SECTOR AND HAS HAD STRONG GROWTH ITSELF, ESPECIALLY IN THE EARLY 2010S

> 60%

of the tech industry[1] is part of the cybersecurity sector or leverages cybersecurity in some way

Growth in cybersecurity industry[1] employment

United states, payroll jobs, 2009 – 2019; Percent of total IT employment



Note: There are limitations to the data available for the cybersecurity sector, as it does not have its own industry or occupational codes. Often, the data we pull for the cybersecurity sector can include data for other subsectors of the tech industry – e.g., software development – that is closely tied to the cybersecurity industry and its skills.

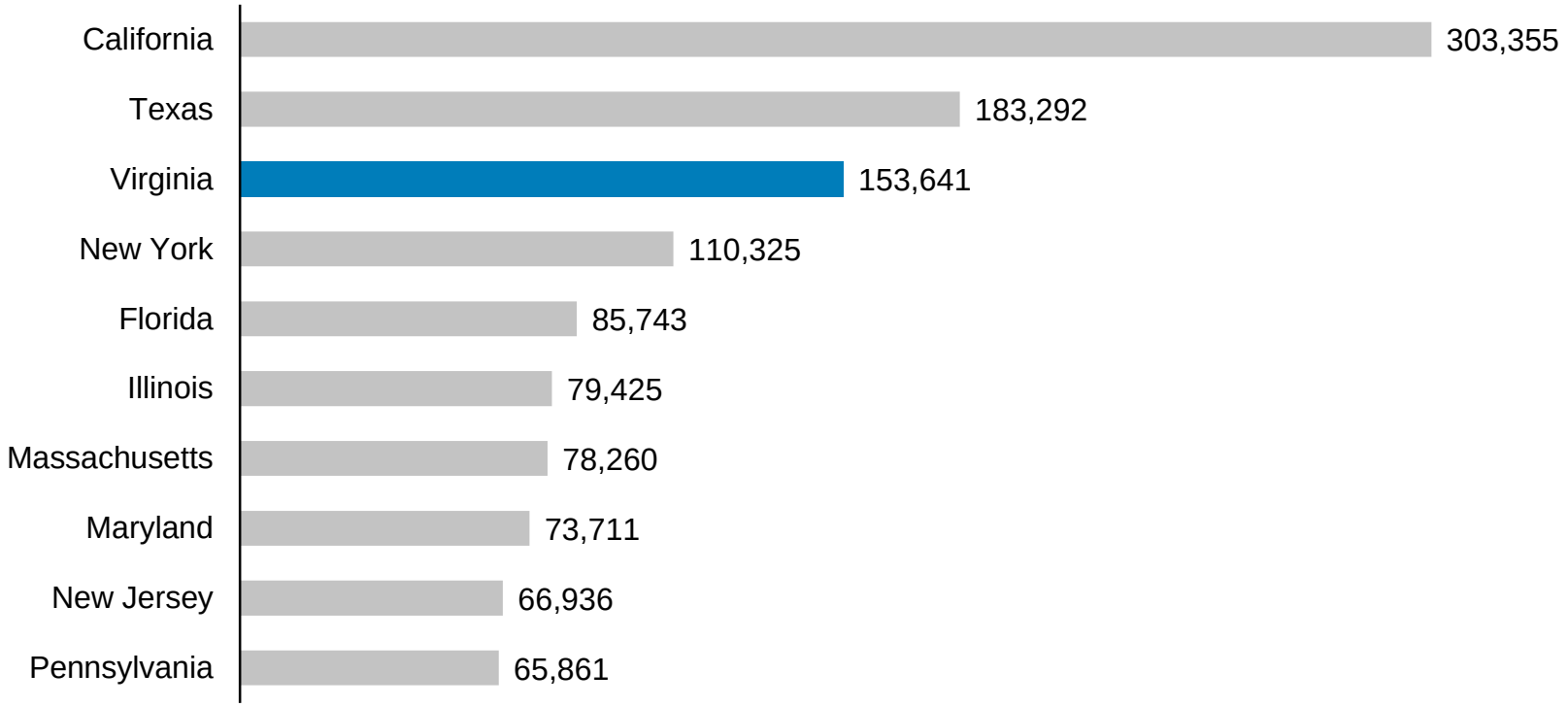
1 Cybersecurity industry includes: Computer Programming Services (541511) and Computer Systems Design Services (541512). Tech industry includes cybersecurity, as well as Other Computer Related Services (541519) and Software Publishers (511210)

Source: Emsi 2019.4

VIRGINIA HAS CAPITALIZED ON THE CYBER BOOM, WITH THE THIRD LARGEST CYBERSECURITY INDUSTRY IN THE COUNTRY

Employment in cybersecurity industry[1]

Payroll jobs, 2019



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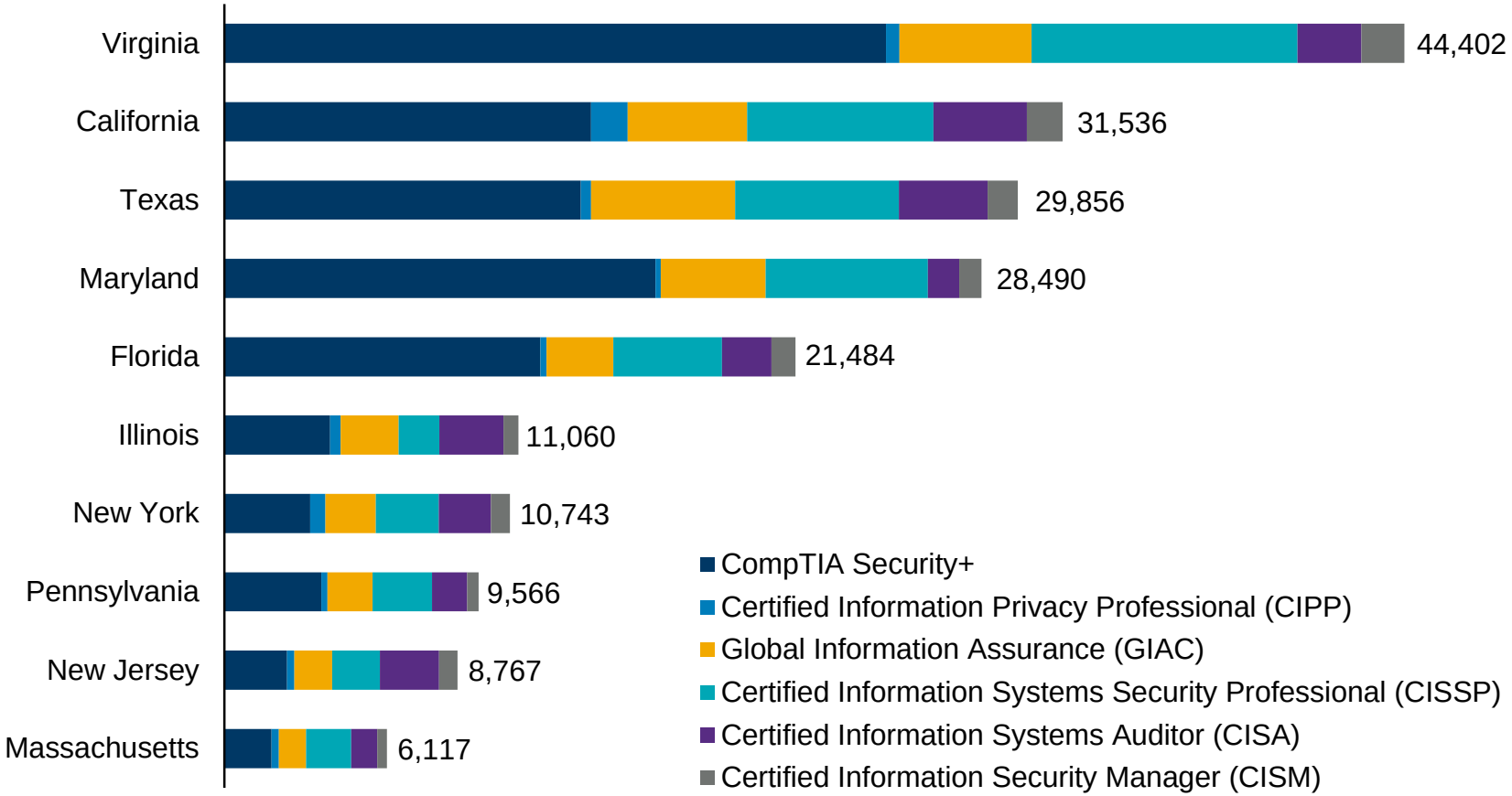
[1] NAICS: Custom Computer Programming Services (541511) and Computer Systems Design Services (541512)
Source: Emsi 2019.4

MOST IMPRESSIVE, VIRGINIA HAS THE LARGEST CREDENTIALED CYBER WORKFORCE IN THE COUNTRY

Cybersecurity credential holders

Number of workers holding select credentials, 2017



Source: Cyberseek.org

THE COMMONWEALTH HAS COMMITTED TO INVESTMENTS IN CYBER, NAMELY WITH THE COMMONWEALTH CYBER INITIATIVE

The **Commonwealth Cyber Initiative** supports **research, talent development, and innovation** at the intersection of **data, autonomy and security**.

320
Faculty members

21
Universities

$20M
Annual state investment

$99M+
Sponsored research

THE RECENT TECH TALENT INVESTMENT PROGRAM COMMITMENT BY THE COMMONWEALTH ALSO DIRECTLY SUPPORTS CYBER

The Commonwealth's TTIP commitment directly supports computer science and computer engineering talent development….

Virginia's **$1.1B tech talent investment fund** will support:

- Growth of Bachelor's and Master's in computer science, computer engineering and software development
- Community college tech degrees and transfers
- Expanded tech industry internships for all students
- K-12 STEM & computer science experience for students

At least 31K *additional* tech grads by 2040 above baseline 34K tech grads

… Aligning with top degrees held by employees in the cybersecurity industry[1]

Terminal degree programs for profiles in cybersecurity industry, N = 1.96 million

Degree fields	Number of degrees
Computer Science, Computer Engineering	153,796
Business Administration, Management and Operations	135,700
Marketing	41,164
Communication and Media Studies	37,814
Electrical, Electronics and Communications Engineering	31,302
Business/Commerce, General	31,238
Engineering, General	28,591

[1] Custom Computer Programming Services (541511) and Computer Systems Design Services (541512)
Source: Emsi 2019.4

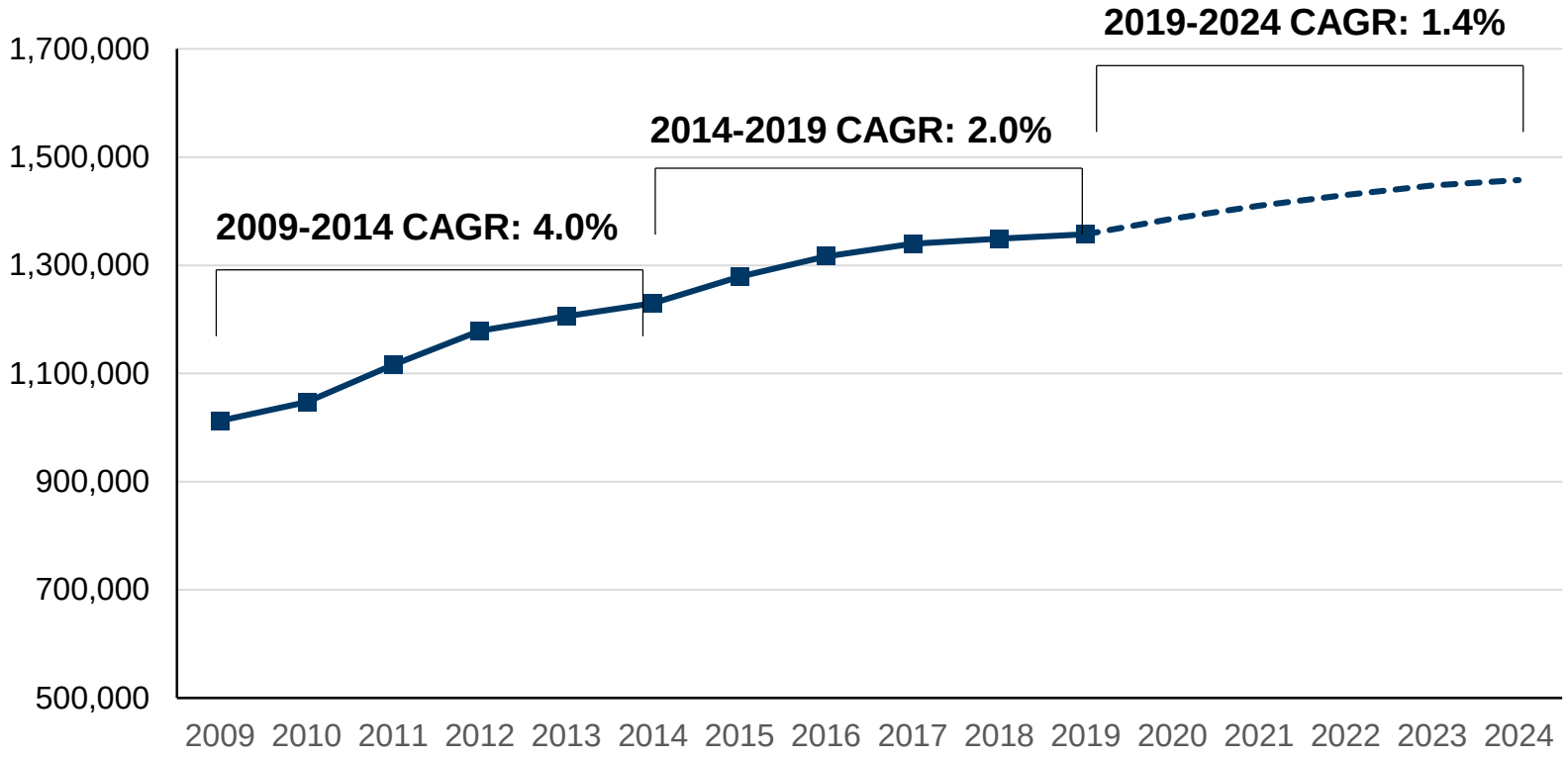
CIT'S MACH37™, A CYBERSECURITY-FOCUSED ACCELERATOR, SUPPORTS YOUNG CYBER COMPANIES IN THE COMMONWEALTH

- Since its first cohort in Fall 2013, the MACH37™ Accelerator has supported 57 innovative cyber start-ups in areas including: cybersecurity, autonomous vehicles, artificial intelligence, cyber-physical systems, IoT and industrial control systems
- Of all MACH37™ graduates, 73% are still in business and 60% have raised follow-on investment, further establishing Virginia as a hub for cyber start-ups
- VEDP works with MACH37™ on a variety of lead generation activities, such as RSA, Black Hat, and Collision, to encourage increased investment in Virginia's cybersecurity industry

GROWTH OF PURE CYBER EMPLOYMENT IS PROJECTED TO SLOW DOWN NATIONALLY…

Growth in cybersecurity occupational[1] employment

United States, jobs, 2009 - 2024



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[1] Six occupations, including: Computer and Information Systems Managers, Information Security Analysts, Database Administrators, Network and Computer Systems Administrators, Computer Network Architects, and Computer Network Support Specialists

Source: Emsi 2019.4

… BUT CYBER IS BECOMING MORE INTERDISCIPLINARY WITHIN COMPANIES, PROVING THE IMPORTANCE AND PERMANANCE OF CYBERSECURITY NOW AND IN THE FUTURE

> We're now beyond cybersecurity's "whack-a-mole" past of addressing one-off vulnerabilities. The function can — and should — be an essential ingredient to business success.

Companies Need To Rethink What Cybersecurity Leadership Is, Harvard Business Review, 2019

Harvard Business Review

> Cybersecurity should no longer be viewed as a function of IT… It needs to form an integral part of culture and strategy [and] should be reflected in each and every facet of the organization…

Cybersecurity for Industry 4.0, Ernst & Young, 2018

EY

> Cybersecurity is now the responsibility of **everyone** in your organization, not just your information technology department.

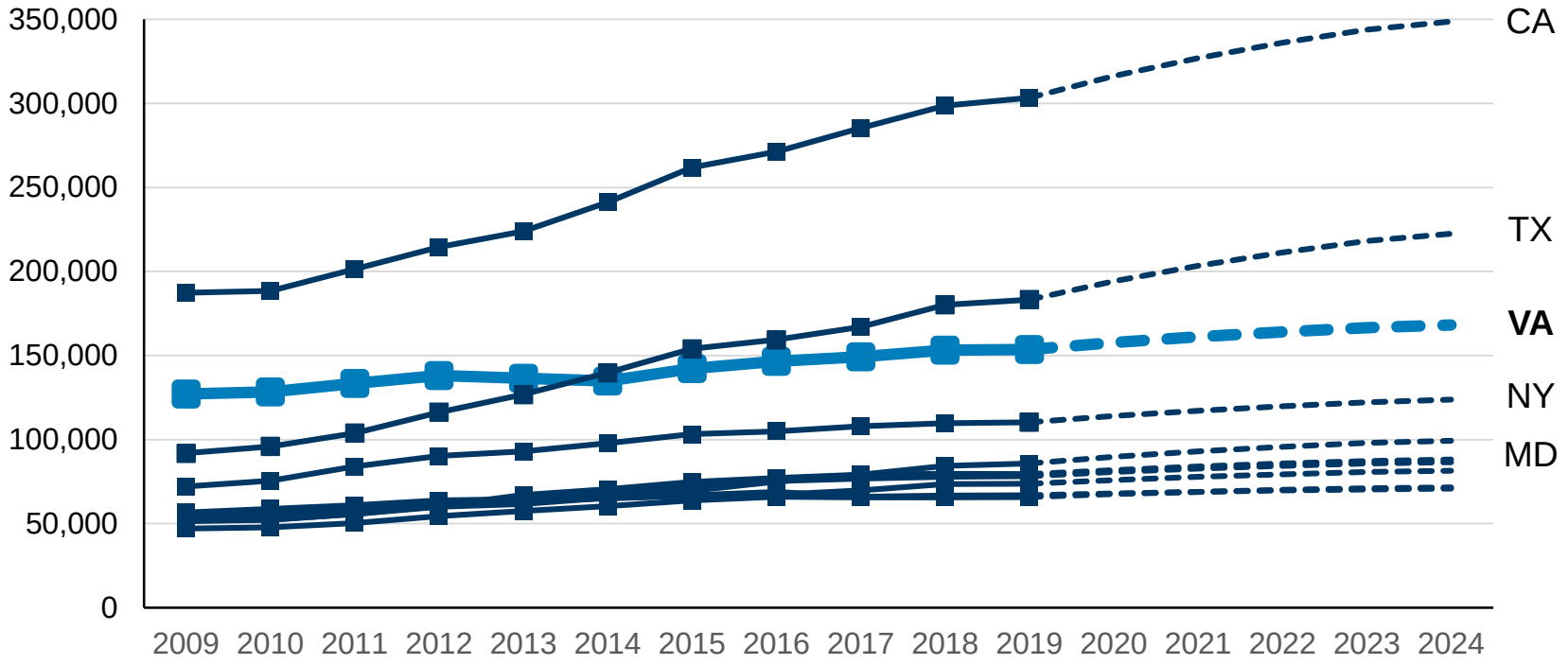
Tom Relihan, MIT Sloan's Ideas Made to Matter, 2019

MIT MANAGEMENT SLOAN SCHOOL

CYBER GROWTH IN VIRGINIA IS EXPECTED TO BE MORE STAGNANT THAN OUR TOP COMPETITORS, CA AND TX

Growth in cybersecurity industry[1] employment

Top ten states by employment, payroll jobs, 2009 - 2024



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[1] Custom Computer Programming Services (541511) and Computer Systems Design Services (541512)
Source: Emsi 2019.4

VEDP HAS IDENTIFIED TWO KEY OPPORTUNITES FOR VA IN CYBER

1. Geographic diversity

Concentrated efforts to grow Virginia's cybersecurity industry outside of Northern Virginia

2. Private sector growth

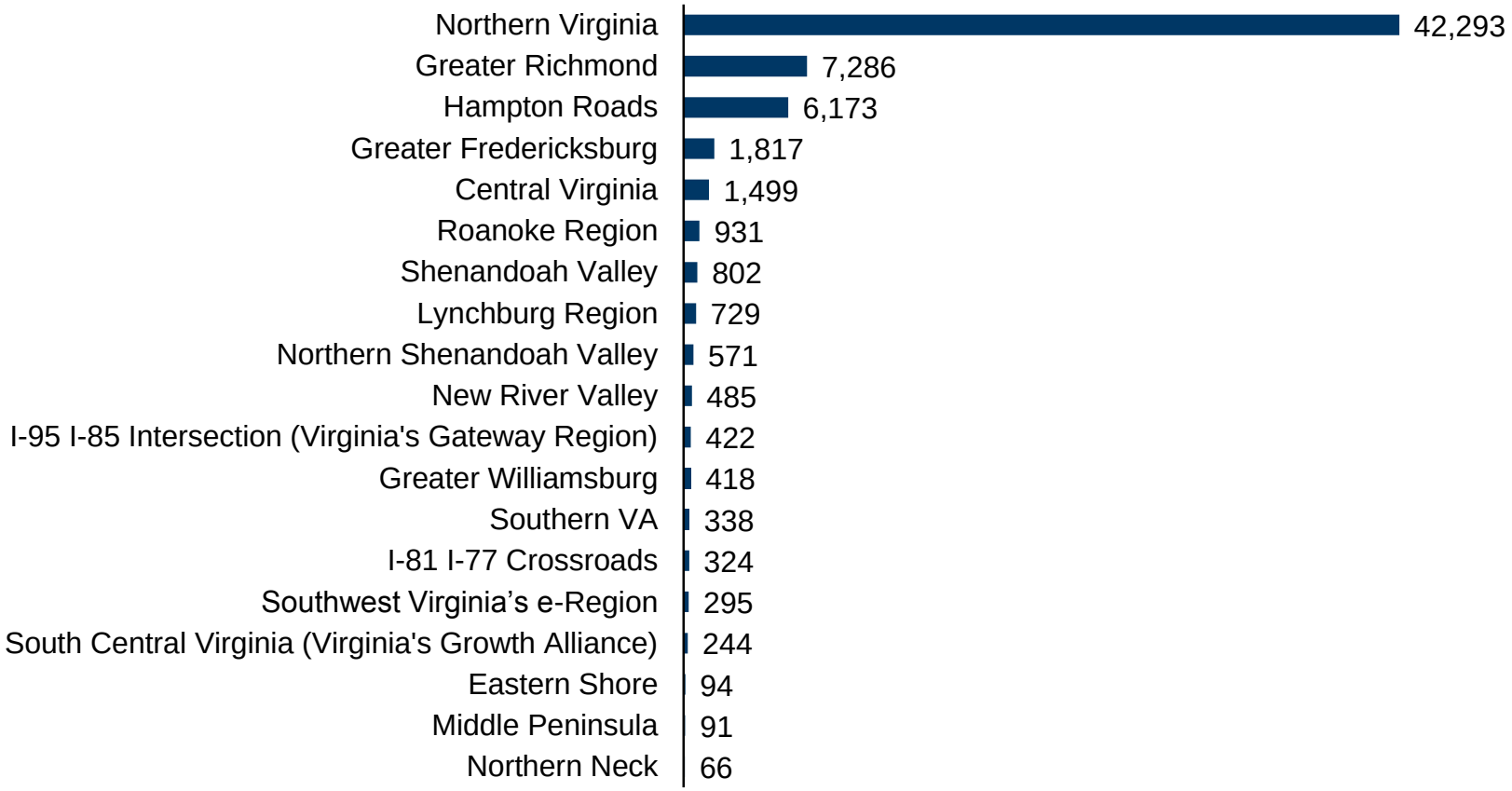
An expansion of focus to private sector-focused cyber companies, vs. the public sector industry and its contractors

MITRE, Fairfax County

1. UNDERSTANDABLY, CYBERSECURITY OCCUPATIONAL EMPLOYMENT IS HIGHLY CONCENTRATED IN NORTHERN VIRGINIA

Cybersecurity industry[1] employment by region

Payroll jobs, 2019



[1] Custom Computer Programming Services (541511) and Computer Systems Design Services (541512)

Source: Emsi 2019.4

1. EDUCATIONAL INSTITUTIONS *ACROSS* VIRGINIA PRODUCE CYBER TALENT THAT CAN FULFILL THE NEEDS OF POTENTIAL COMPANIES

NSA/DHS Centers of Academic Excellence in Cybersecurity

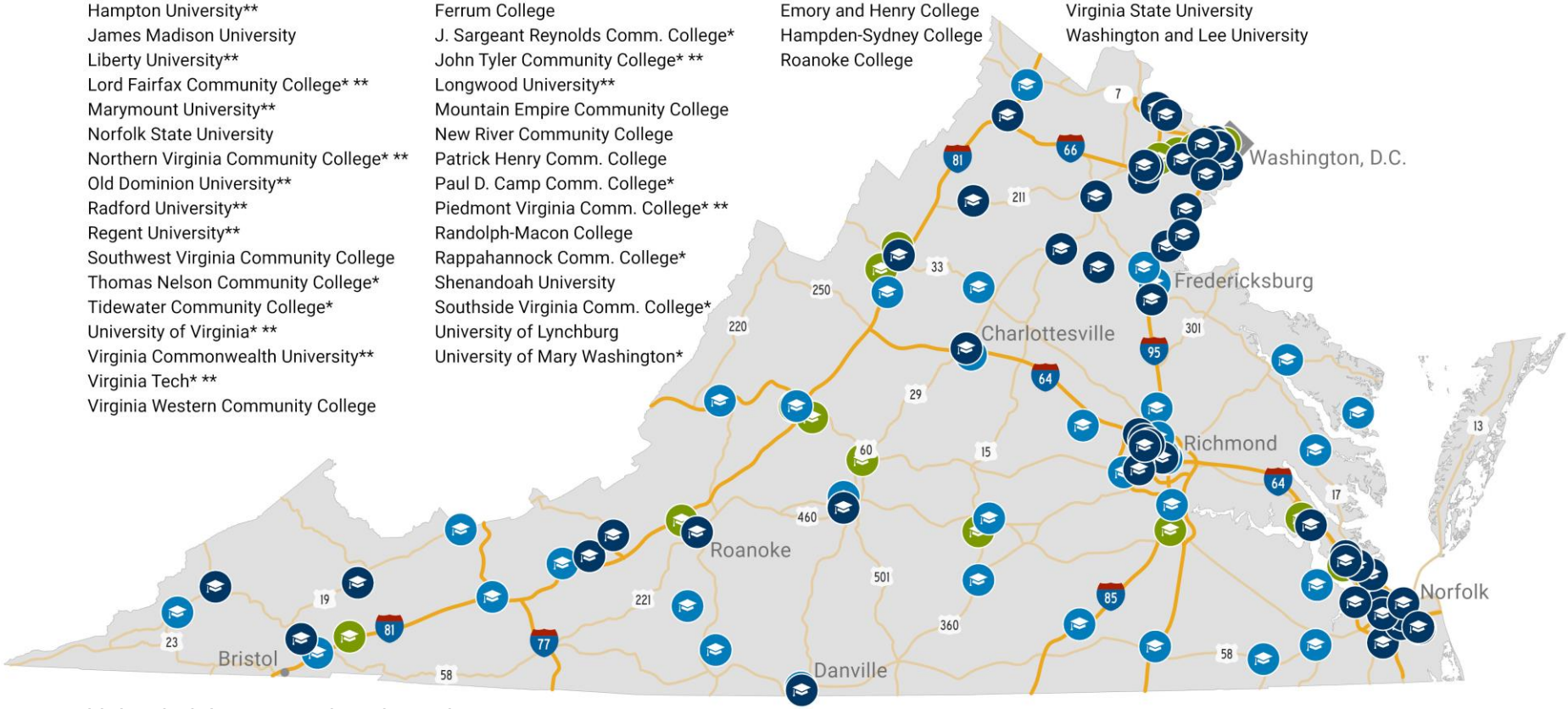
Danville Community College
ECPI University*
George Mason University* **
George Washington University*
Germanna Community College*
Hampton University**
James Madison University
Liberty University**
Lord Fairfax Community College* **
Marymount University**
Norfolk State University
Northern Virginia Community College* **
Old Dominion University**
Radford University**
Regent University**
Southwest Virginia Community College
Thomas Nelson Community College*
Tidewater Community College*
University of Virginia* **
Virginia Commonwealth University**
Virginia Tech* **
Virginia Western Community College

Other Cybersecurity Programs of Study

Averett University* **
Blue Ridge Community College
Bluefield College**
Central Virginia Community College
Dabney S. Lancaster Comm. College
Ferrum College
J. Sargeant Reynolds Comm. College*
John Tyler Community College* **
Longwood University**
Mountain Empire Community College
New River Community College
Patrick Henry Comm. College
Paul D. Camp Comm. College*
Piedmont Virginia Comm. College* **
Randolph-Macon College
Rappahannock Comm. College*
Shenandoah University
Southside Virginia Comm. College*
University of Lynchburg
University of Mary Washington*

Other Computer Science and Computer Engineering Programs of Study

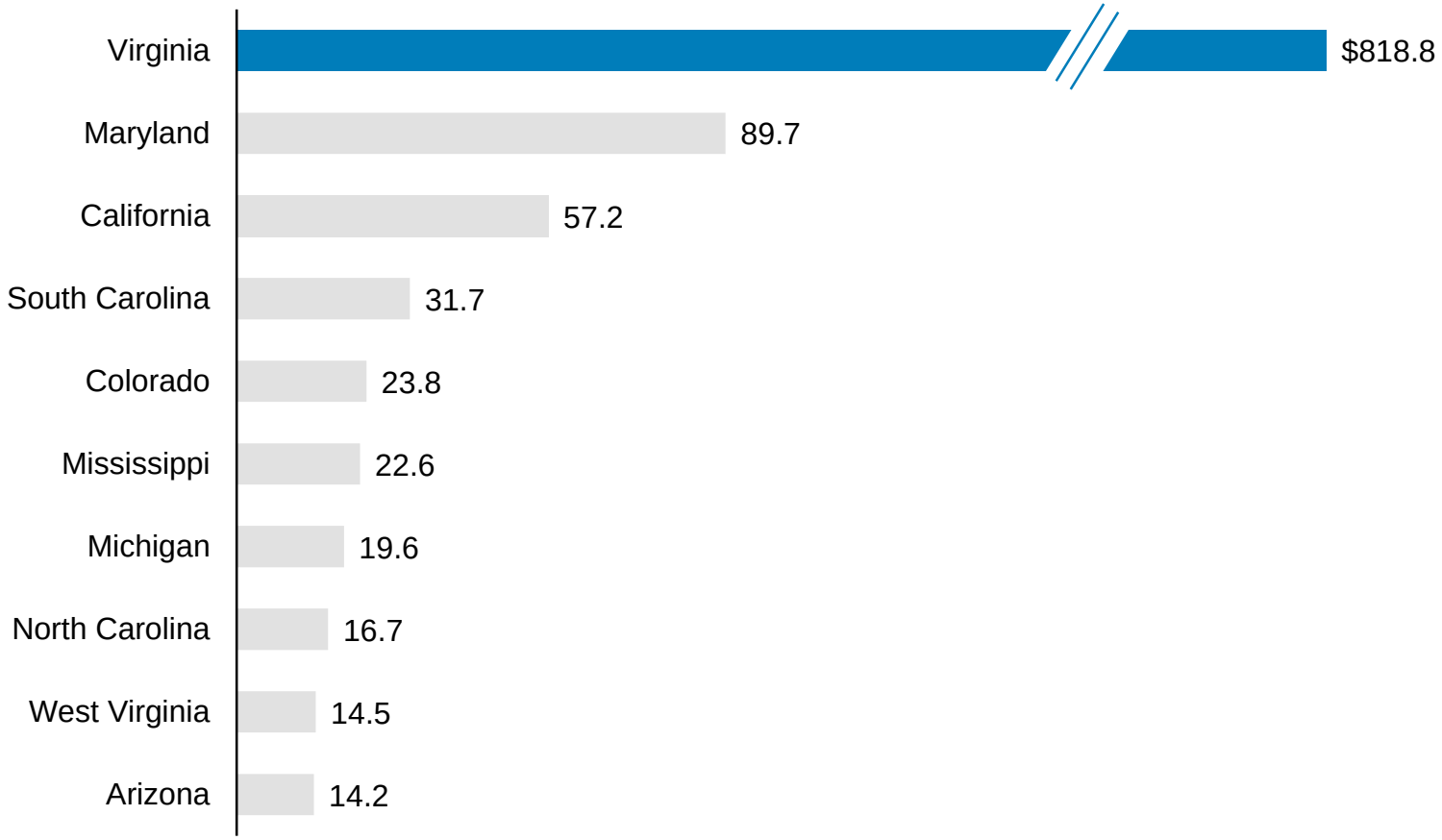
Bridgewater College
Christopher Newport University
College of William and Mary
Columbia College*
Eastern Mennonite University
Emory and Henry College
Hampden-Sydney College
Roanoke College
Southern Virginia University
Sweet Briar College
University of Management and Technology
Virginia International University
Virginia State University
Washington and Lee University



*Multiple Virginia campus locations shown
**School with cybersecurity degree and computer science/engineering degree
Source: NSA, SCHEV, VEDP analysis of institution websites

2. VIRGINIA'S CYBER INDUSTRY IS KNOWN FOR FEDERAL CONTRACTING

Federal spending on cybersecurity services
M$, FY2019, Cybersecurity and Data Backup Services[1]



[1] Product Service Code D310
Source: USASpending.gov

2. MEANWHILE, VIRGINIA EASILY MEETS PRIVATE SECTOR-FOCUSED CYBER COMPANIES' KEY LOCATION DECISION DRIVERS

Key trends in cyber location decisions	Details	Current Virginia context
Skilled workforce and talent pipeline	▪ Primary driver of location decisions for cyber projects ▪ Require an existing, credentialed cyber workforce ▪ Value veteran workforce given exposure to cybersecurity issues and training ▪ Need a nearby pipeline of talent for cybersecurity credentials and degrees, for new hires and upskilling	▪ 3rd largest base of cybersecurity employees in the country ▪ Largest pool of credentialed cyber workers in the country ▪ 4th largest population of veterans nationally, with pecific programs like *Cyber Vets Virginia* and *NVTC Veterans Employment Initiative* to help match veterans with cyber jobs ▪ Cyber programs across the state at the credential, 2-year and 4-year level
Research and partnerships	▪ Value partnerships to utilize cyber-specific research assets for training and upskilling employees ▪ Utilize testing facilities and work with university teams to research and test product capabilities	▪ $4M investment in the Virginia Cyber Range to support cyber education across the state ▪ GoVirginia investment in the Cyber Arena to test and evaluate cyber technologies ▪ Investments in cybersecurity from top Virginia schools, including Tech, UVA, GMU
Broadband/ Fiber	▪ Strong, fast, and secure digital connectivity is a minimum requirement	▪ Strong connectivity for commercial broadband backbones ▪ 92% broadband access across Virginia

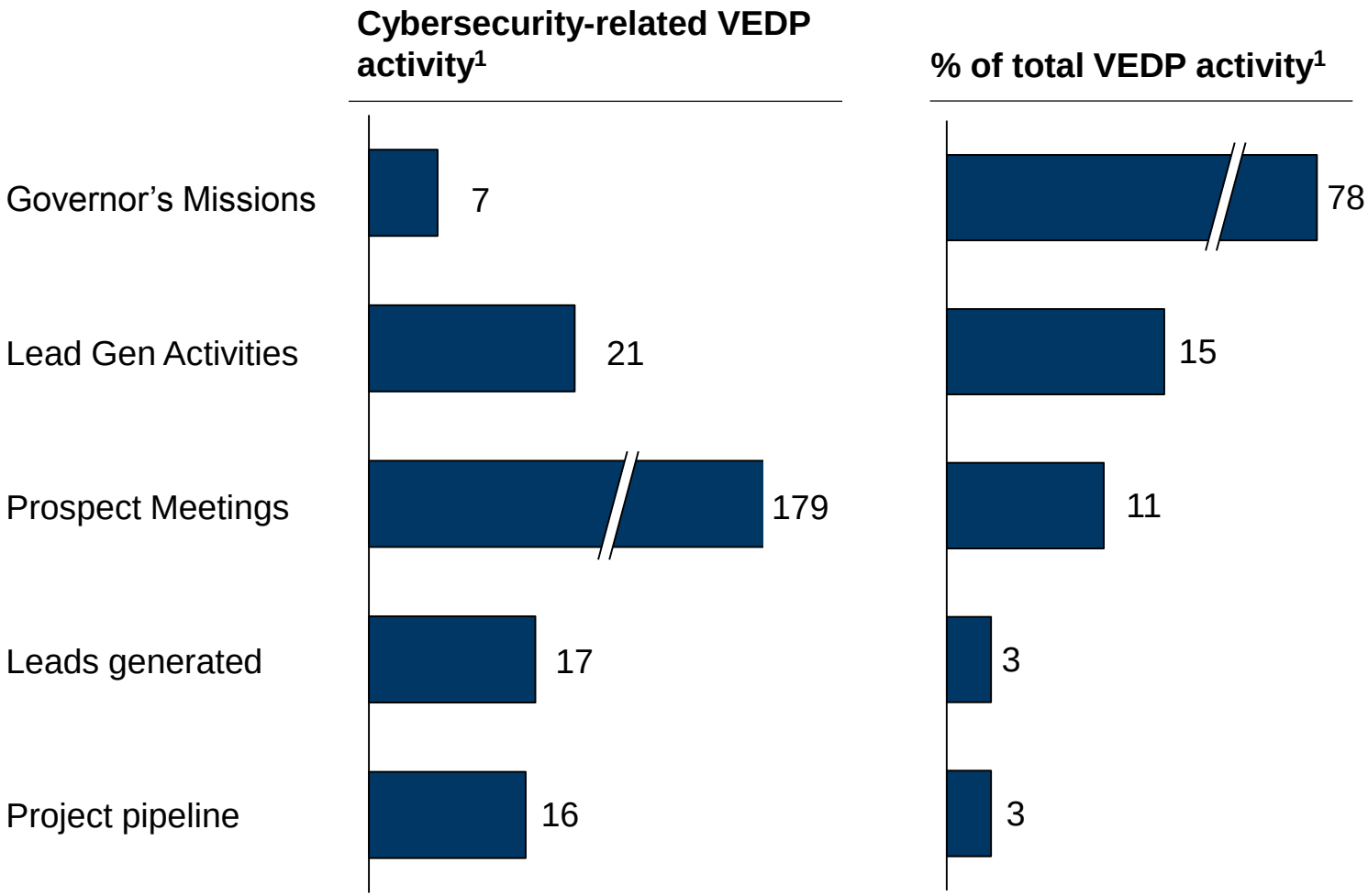
VEDP HAS TAKEN STEPS TO EXPLORE CYBER OPPORTUNITIES AND PRIORITIZE THE CYBERSECURITY INDUSTRY AT LARGE IN OUR BUSINESS DEVELOPMENT EFFORTS (1/2)

Type of change or action	Select examples
Strategic	▪ Pivoted to sector-focused business development efforts, of which cybersecurity is a key target ▪ Developed industry strategies focused on tactical high-yield lead generation efforts for the cybersecurity sector, including how to focus our efforts on high value targets ▪ VEDP's Rural and Small Metro Tech Center Initiative will focus on cybersecurity in one of its next phases
Organi-zational	▪ Designated a Business Investment Manager to lead the cybersecurity industry effort ▪ Business development efforts supported by a Research Manager who is focusing on key economic trends, current news, and potential business development opportunities in the cybersecurity sector ▪ Business development efforts supported by Economic Competitiveness Manager executing a corporate intelligence program to identify cybersecurity companies that are best positioned to expand in the near team that VEDP should target ▪ Launched a Business Retention & Expansion team, that in part targets Virginia's key cybersecurity companies for retention, as well as expansion opportunities

VEDP HAS TAKEN STEPS TO EXPLORE CYBER OPPORTUNITIES AND PRIORITIZE THE CYBERSECURITY INDUSTRY AT LARGE IN OUR BUSINESS DEVELOPMENT EFFORTS (2/2)

Type of change or action	Select examples
Tactical	▪ Prioritized the cybersecurity sector for a new corporate intelligence effort led by the Economic Competitiveness team, in which VEDP takes a data-oriented approach to identifying companies in our target sectors ▪ Executed 10 lead generation activities targeting the cybersecurity sector in FY18 and FY19, and will execute 12 cybersecurity lead generation activities in FY20 ▪ Enhanced new VEDP website that includes comprehensive information promoting Virginia's cybersecurity assets ▪ Developed new marketing collateral for cybersecurity sector, including promoting largest cyber workforce in Eastern U.S., recent investments in tech talent pipeline, Centers of Academic Excellence in Cyber Operations and Defense, Commonwealth Cyber Initiative, and proximity to federal cybersecurity assets, among others ▪ Business Retention and Expansion program targeting high-value companies
Partnership	▪ VEDP has active partnerships with the following allies in Virginia: – Northern Virginia Technology Council (NVTC): Hosted international delegations of cybersecurity companies interested in U.S. expansion, resulting in several project opportunities for VA – Commonwealth Cyber Initiative: VEDP has introduced CCI to Virginia companies interested in research partnerships with nodes across the state – CIT: Continuing discussions to leverage Mach37 funding for statewide cybersecurity entrepreneurship and collaboration on lead generation activities

15% OF VEDP'S LEAD GEN ACTIVITIES ARE FOCUSED ON THE CYBERSECURITY SECTOR, AND ~80% OF GOVERNOR'S MISSIONS, OUR HIGHEST PROFILE ACTIVITY, INVOLVE CYBER ACTIVITY



1 Reflects activities from July 2018 to Dec. 2019, with Governor's Missions reflected from Jan. 2018 to Dec. 2019

THE COMMONWEALTH CAN CONTINUE TO STRENGTHEN ECONOMIC DEVELOPMENT IN THE CYBERSECURITY INDUSTRY

Next steps for VEDP

- Target opportunities related to cybersecurity trends and existing Virginia sectors (e.g., cybersecurity for unmanned systems)
- Execute a corporate intelligence strategy to identify and target high potential cybersecurity companies, including a specific effort around private sector-serving cybersecurity
- Successfully complete a Rural and Small Metro Tech Centers effort for cybersecurity to create more activity in cyber beyond Northern Virginia
- Market key Virginia cyber assets to attract opportunities (e.g., existing cyber workforce, Virginia Cyber Range, etc.)
- Continuing to build relationships with and support key stakeholders and industry leaders that help Virginia navigate related opportunities

How Virginia can continue to capitalize on cybersecurity

- Support and grow cybersecurity degree and certification programs across the Commonwealth
- Support and grow all four-year technology degree programs across the Commonwealth (e.g. through TTIP), knowing that this is a foundation for cybersecurity employees
- Identify intersections of cybersecurity and other key Virginia sectors (e.g., unmanned systems), and provide resources/ access to research assets for companies at those intersections

APPENDIX

THREE (IMPERFECT) WAYS TO MEASURE THE CYBERSECURITY WORKFORCE

Cybersecurity is notoriously difficult to pin down. There are three (imperfect) was to measure its size and characteristics:

Cybersecurity industry employment: Cybersecurity firms are primarily classified under two different industry codes in the North American Industry Classification (NAICS) system: Custom Computer Programming Services (541511) and Computer Systems Design Services (541512). However, these industries also include a broad range of other types of IT firms and thus overstate the true extent of cybersecurity employment. Industry employment also includes people in cybersecurity firms who are not cybersecurity professionals (e.g. accountants).

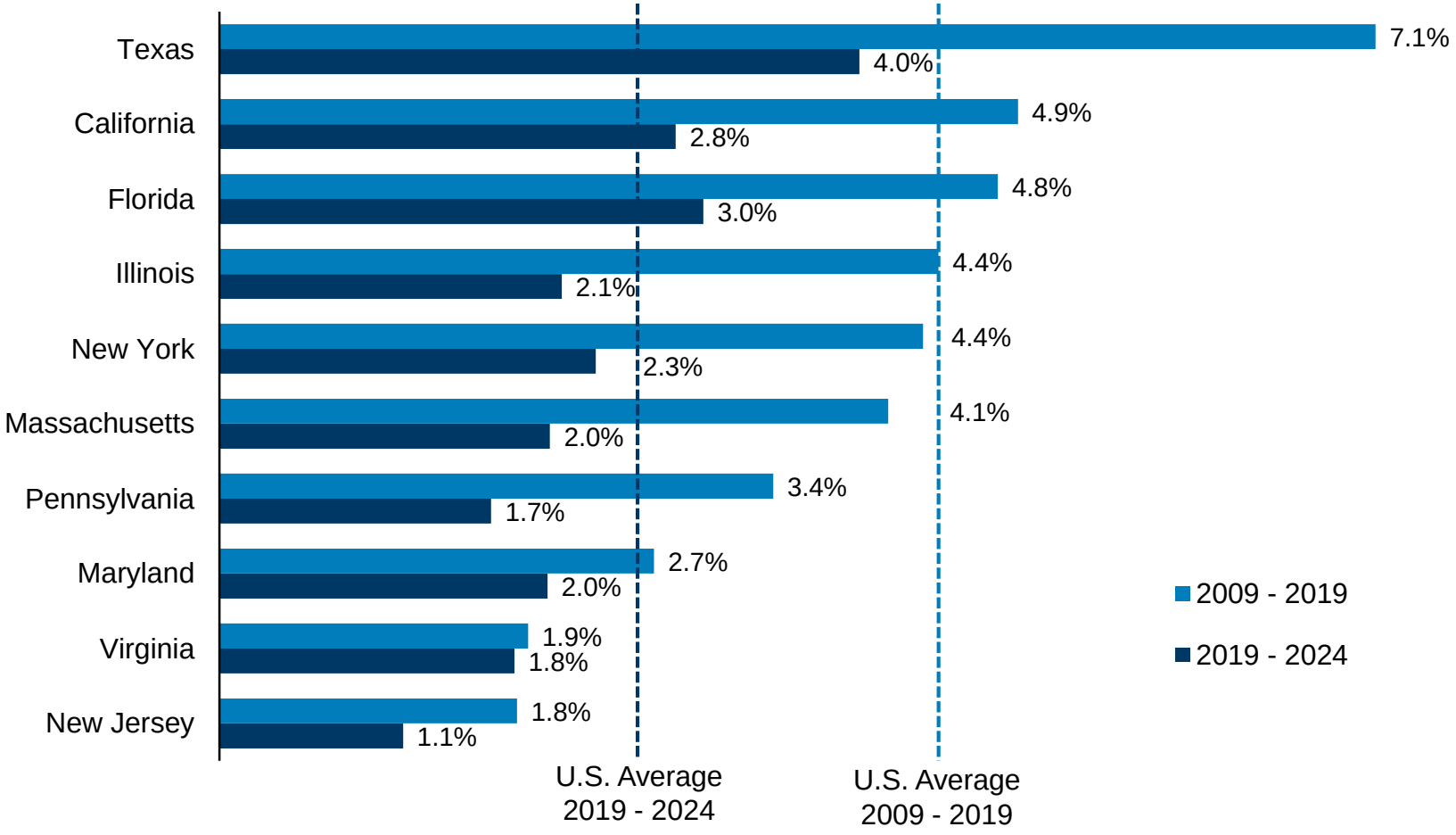
Cybersecurity occupational employment: Cybersecurity occupations are primarily covered by six different Standard Occupational Classification (SOC) groups, including Computer and Information Systems Managers, Information Security Analysts, Database Administrators, Network and Computer Systems Administrators, Computer Network Architects, and Computer Network Support Specialists. While most people working in these occupation have various cybersecurity skills, many would not be considered cybersecurity professionals.

Cybersecurity skills: Powerful, new analytical tools allow researchers to look beyond employers and job titles and measure the prevalence of specific cybersecurity skills. This provides the most granular picture of the cybersecurity workforce, but is subject to some important limitations – e.g. based on what people report on social media profiles.

ACROSS ALL TOP CYBERSECURITY STATES, INDUSTRY EMPLOYMENT GROWTH IS EXPECTED TO SLOW OVER NEXT 5 YEARS

Cybersecurity industry[1] employment CAGR

Payroll jobs, 2009 – 2019 & 2019 - 2024



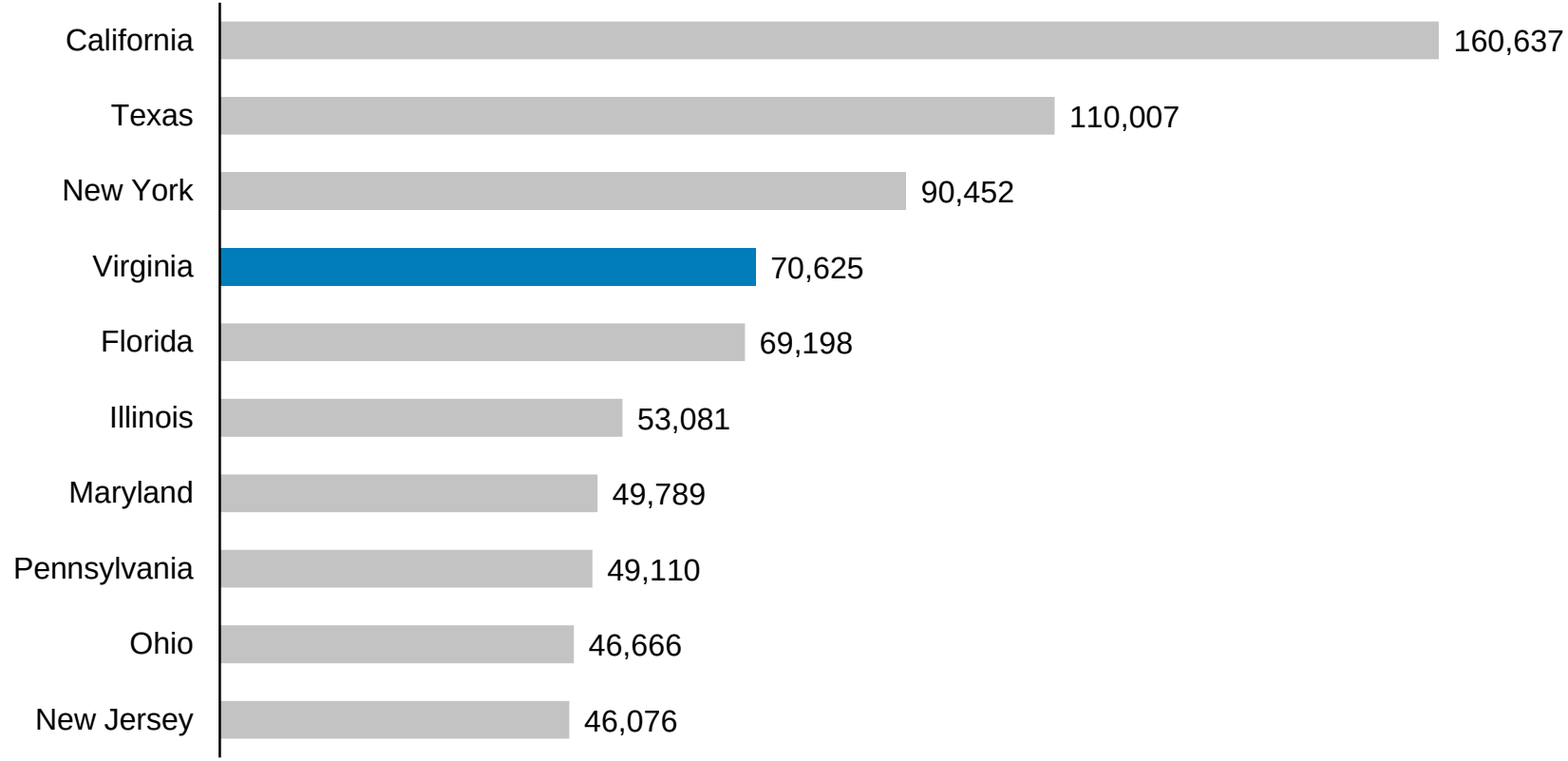
[1] Custom Computer Programming Services (541511) and Computer Systems Design Services (541512)

Source: Emsi 2019.4

VIRGINIA IS HOME TO THE FOURTH HIGHEST LEVEL OF EMPLOYMENT IN CORE CYBERSECURITY OCCUPATIONS

Employment in cybersecurity Occupations[1]

Jobs, 2019



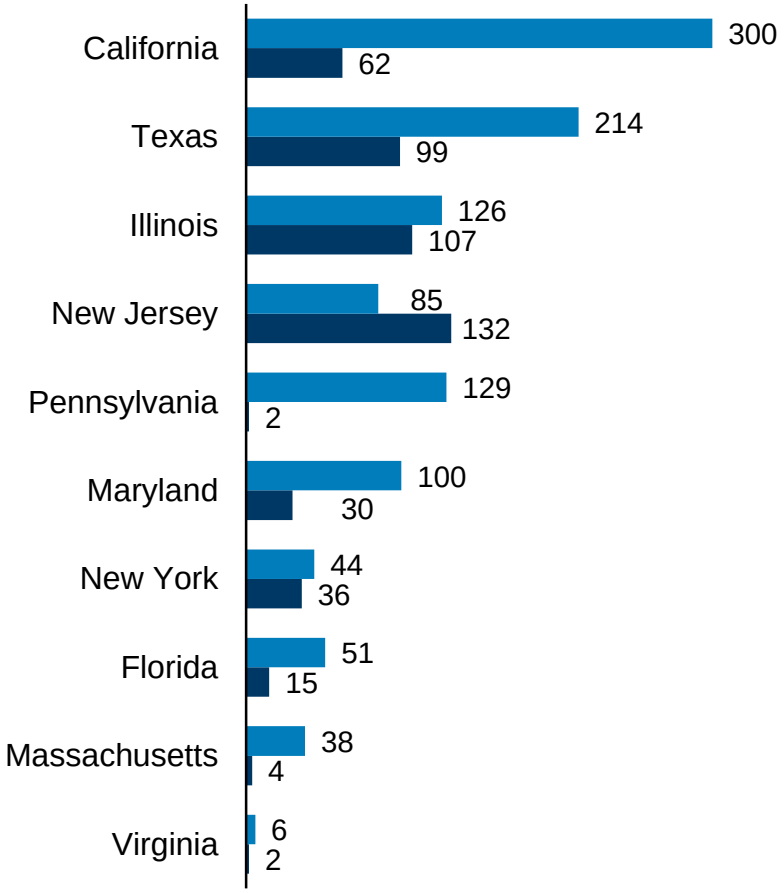
1 Six occupations, including: Computer and Information Systems Managers, Information Security Analysts, Database Administrators, Network and Computer Systems Administrators, Computer Network Architects, and Computer Network Support Specialists

Source: Emsi 2019.4

VIRGINIA UNDERPERFORMS WITH REGARD TO CYBERSECURITY CREDENTIAL PRODUCTION

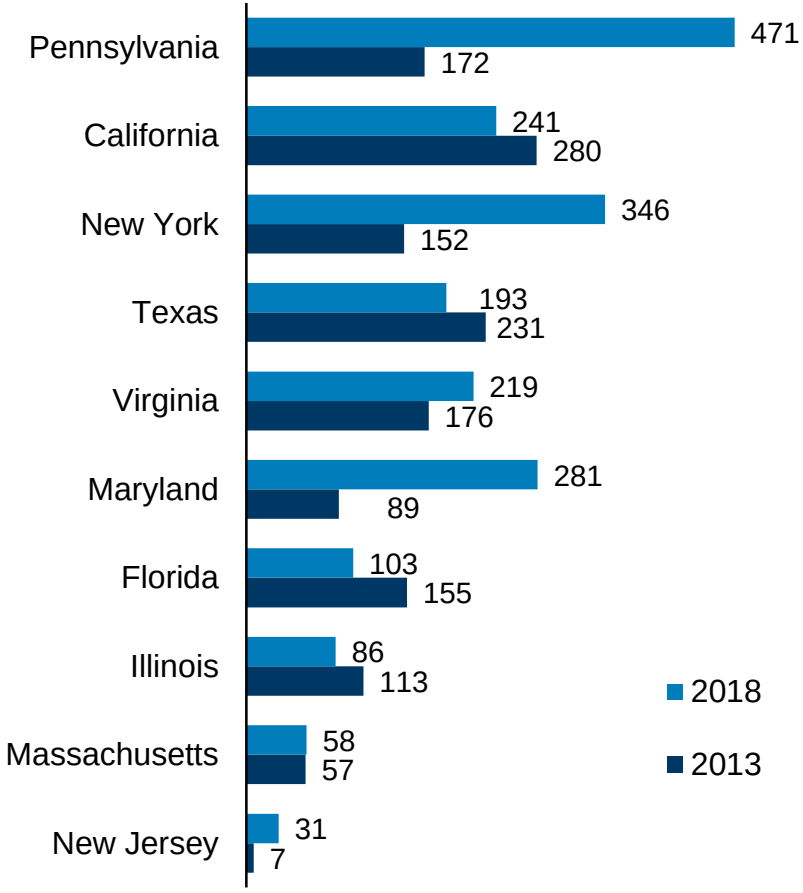
Cybersecurity certificates[1]

Certificates awarded, 2013 & 2018



Cybersecurity degrees[1]

Degrees awarded, 2013 & 2018



[1] CIP code 11.1003, non-distance programs only

Source: Emsi Profile Analytics, profiles updated since 2017